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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/915,396	07/27/2001	Atsumi Yamaguchi	211909US-2 CIP	7908

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EXAMINER	
DEO, DUY VU NGUYEN	
ART UNIT	**PAPER NUMBER**
1765	

DATE MAILED: 12/03/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/915,396	YAMAGUCHI ET AL.	
	Examiner	Art Unit	
	DuyVu n Deo	1765	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *22 October 2003*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-18* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *14-18* is/are allowed.

6)☒ Claim(s) *1-4 and 8-11* is/are rejected.

7)☒ Claim(s) *5-7, 12, 13* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. §§ 119 and 120

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

13)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

a) ☐ The translation of the foreign language provisional application has been received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____.
4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other:

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality and the advisory of the previous Office actions has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 10/22/03 has been entered.

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.
>
> (e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

2. Claims 1, 8 are rejected under 35 U.S.C. 102(e) as being anticipated by Oh et al. (US 6,200,903).

Oh describes a method for etching a semiconductor device comprising: forming an etching object, polysilicon layer, on the substrate; forming a resist film having a thickness of 650 nm on the etching object (this thickness must be predetermined in order to know the thickness

for putting down the resist for this step); patterning the resist film into a pattern; performing ion implantation at an tilted angle (claimed obliquely) having dose of 1E15 to 5E16 ions/cm2 (this ion dose must be predetermined in order to know the dose for this step) into the resist pattern to reduce the resist thickness by about 30-40% (claimed a second predetermined thickness or contracted to a second thickness); etching the polysilicon layer using the resist film as a mask (col. 3, line 13-38; line 65-68). Since Oh performs the same process, ion implantation using Ar, which is the same as that of claimed invention. Therefore, his resist thickness would also be contracted by the ion implantation process as that of claimed invention.

Referring to the limitation of the second thickness would make the difference in CD shift in the work pattern with respect to the first resist pattern caused between a dense pattern portion and a rough pattern portion in the work pattern is not more than a predetermined reference value and does not hinder the predetermined etching, this limitation describes the affect that results directly from the thickness of the resist. Since Oh's first predetermined thickness is 650nm (col. 3, line 19), which is between the workable resist thickness of 585nm and 880 nm and Oh's second thickness is predetermined to be at 30-40% less than the first thickness, his second thickness would also have the claimed benefit. It is the applicant's burden to show that Oh's method would result in a second thickness that does not provide the above benefit.

Column 3, line 19 discloses a resist thickness of 650nm (or 6500 angstroms), which is between the workable resist thickness of 585nm and 880 nm, disclosed in the pages 28 and 32 of specification. Also, column 4, line 21-34, describes by applying ion implantation, the thickness of the resist can be less by about 30-40% than for the conventional case to provide an easy photolithography process. Since the critical dimension shift depends on the second thickness and

Oh's second thickness is predetermined to be at 30-40% less than the first thickness, his second thickness would have a predetermined critical dimension shift that it corresponds to because he describes the same ion implantation step and his thickness is within the workable thickness as described by the specification.

3. Claim 1 is rejected under 35 U.S.C. 102(b) as being anticipated by Kobayashi (JP 4127518A).

Kobayashi describes a method etching a semiconductor device comprising: forming an etching object, poly layer, on the substrate; forming and patterning a resist on the poly layer; performing ion-implantation having dose of 1x10E14 ions/cm2 or more (this ion dose must be predetermined in order to know the dose for this step) into the resist pattern, and therefore reducing the resist thickness; etching the poly layer to form a work pattern (pages 4-5 of the translation; fig. 1). The resist thickness is reduced from 0.6um (600nm) (this thickness must be predetermined in order to know the thickness for putting down the resist) to 0.45 um (450 nm) (claimed second predetermined thickness) (page 9, embodiment 2; claim 2). Since the critical dimension shift depends on the second thickness and Kobayashi's first thickness is within workable range of 880 nm of the embodiment 5 according to the invention and the second thickness is predetermined to be less than the first thickness, his second thickness would have a predetermined critical dimension shift that it corresponds to.

Referring to the limitation of the second thickness would make the difference in CD shift in the work pattern with respect to the first resist pattern caused between a dense pattern portion and a rough pattern portion in the work pattern is not more than a predetermined reference value

and does not hinder the predetermined etching, this limitation describes the affect that results directly from the thickness of the resist. Since Kobayashi's first predetermined thickness is 600nm, which is between the workable resist thickness of 585nm and 880 nm, and it is reduced to a second of 450 nm following the ion implantation step, his second thickness would also have the claimed benefit. It is the applicant's burden to show that Kobayashi's method would result in a second thickness that does not provide the above benefit.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. Claims 2 and 3 are rejected under 35 U.S.C. 103(a) as being unpatentable over Oh as applied to claim 1 above, and further in view of applicant's admitted prior art.

Referring to claim 2, forming insulating film including silicon nitride is requisite in the conventional etching of the wiring pattern forming method as described in page 3, line 13 of specification. The silicon nitride (claimed ion prevention film) would further prevent ion implanted into the etching object since it covers the etching object.

Referring to claim 3, forming the silicon nitride by plasma CVD is a technique that is well known to one skilled in the art at the time of the invention (please see cited Wolf et al. below).

6. Claims 2-4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Oh or Kobayashi as applied to claim 1 above, and further in view of Bell (US 5,767,018).

Referring to claims 2-4, using materials such as nitride, oxynitride, or organic ARC (claimed ion prevention films) is well known to one skill in the in fabricating of semiconductor process as anti-reflective coating (ARC) as shown here by Bell. They are deposited by CVD (col. 1, line 11-35, line 55-65; col. 7, line 41-49). It would have been obvious for one skill in the art at the time of the invention to modify Oh's method in view of Bell because Bell teaches that these materials would minimize notches caused by reflections during the photolithographic techniques (col. 1, line 24-26).

7. Claims 9, 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Oh as applied to claim 1 above, and further in view of Geusic et al. (US 6,518,615).

Unlike claimed invention, Oh doesn't describe the etching object (or polysilicon) has asperities on its surface. Geusic describes a method for forming memory cells where he teaches to the polysilicon has pores on its surface (claimed asperities on etching object surface) (col. 1, line 51-67). It would have been obvious for one skilled in the art to modify Oh in light of Geusic's teaching of having pores or asperities on the polysilicon surface because they both teach of forming capacitor (Oh: col. 4, line 50, 51; Geusic: col. 1, line 51-52) and the pores would increase the surface area in which it would increase the storage capacity of the capacitor (Geusic: col. 1, line 61-64; Oh: col. 4, line 50-51). Oh further describes impurities may be doped in the polysilicon layer (or etching object) before forming the photoresist (step b) (col. 3, line 16-17). And method for doping the polysilicon layer such as claimed ion implantation is well known to one skilled in the art (please see Wolf et al. cited below).

Referring to claim 10, techniques or steps of forming a pattern on the resist by performing exposure through a reticle and executing development are necessary steps that are

well known to one skilled in the art of forming a resist pattern as shown here by Wolf (please see Wolf et al. cited below).

8. Claim 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over Oh and Geusic as applied to claim 9 above, and further in view of Borodovsky (US 4,529,685).

Referring to claim 11, above prior art doesn't describe the etching object has a mark for mask alignment on its surface. Borodovsky teaches a method of etching reflective surface such as polysilicon (or etching object) where he teaches the etching object has a mark for mask alignment on its surface (col. 1, lines 14-20, 55-57; col. 2, lines 10-15). It would have been obvious for one skilled in the art at the time of the invention to modify the method of above prior art in light of Borodovsky because he teaches that mark on the etching object would ensure the alignment of subsequent mask pattern placed thereon (col. 1, line 55-57; col. 2, line 10-15).

Allowable Subject Matter

9. Claims 5, 6, 12-18 remained allowable.

10. Wolf et al. (Silicon Processing for the VLSI, vol. 1, pages 181-182, 191-195, 407-408) is cited to show prior art.

Response to Arguments

15. Oh teaching of a certain thickness for the resist, at 650 nm, and a certain ion implantation dose, of 1E15 to 5E16 ions/cm2, shows that these processing parameters must be predetermined

in order to carry out the steps of fabrication of the semiconductor device. Without prior knowledge of these values, the device can't be produced. Same argument applied to Kobayashi.

Referring to applicant's argument that Oh doesn't teach the second thickness would make the difference in CD shift in the work pattern with respect to the first resist pattern caused between a dense pattern portion and a rough pattern portion in the work pattern is not more than a predetermined reference value and does not hinder the predetermined etching, this limitation describes the affect that results directly from the thickness of the resist. Since Oh's first predetermined thickness is 650nm (col. 3, line 19), which is between the workable resist thickness of 585nm and 880 nm and Oh's second thickness is predetermined to be at 30-40% less than the first thickness, his second thickness would also have the claimed benefit. Oh may be silent about the benefit of the second thickness; however, the fact that applicant has recognized another advantage which would flow naturally from following the suggestion of the prior art cannot be the basis for patentability when the differences would otherwise be obvious. See *Ex parte Obiaya*, 227 USPQ 58, 60 (Bd. Pat. App. & Inter. 1985). It is the applicant's burden to show that Oh's method would result in a second thickness that does not provide the above benefit. Same argument applied to Kobayashi reference.

In response to applicant's argument that the applied prior art doesn't describe using the silicon nitride film as an ion implantation prevention film, the fact that applicant has recognized another advantage which would flow naturally from following the suggestion of the prior art cannot be the basis for patentability when the differences would otherwise be obvious. See *Ex parte Obiaya*, 227 USPQ 58, 60 (Bd. Pat. App. & Inter. 1985). Again, this benefit is from using

the silicon nitride. Since applied prior art shows using silicon nitride, it would also provide the above benefit.

17. Any inquiry concerning this communication or earlier communications from the examiner should be directed to DuyVu n Deo whose telephone number is 703-305-0515.

DVD
November 19, 2003